

WHAT IS CLAIMED IS:

1. A 3-axis straight-line motion stage comprising:

a bottom plate (40) having predetermined area and thickness;

5 a X-axis stage (10) fixed in a reference area (RR) of the bottom plate (40) for moving in the direction of X-axis a first X area (RX1) positioned from the reference (RR) to the direction of X-axis;

a Y-axis stage (20) positioned within the first X area (RX1) and fixed in a second

X area (RX2) within the first X area (RX1) for moving in the direction of Y-axis a second

10 Y area (RY1) positioned from the second X area to the direction of Y-axis; and

a Z-axis stage (30) fixed in the second Y area (RY2) within the first Y area (RY1) and supporting a predetermined sample for moving the sample in the direction of Z-axis;

wherein, the X-axis, the Y-axis and the Z-axis indicate axes of rectangular coordinates, respectively.

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2. The stage according to claim 1, wherein the X-axis stage (10) comprises a piezoelectric element having a predetermined length, the length being changed in the direction of Y-axis according to an input voltage, and a first X driving part (11-1) and a second X driving part (11-2) connected both ends of a longitudinal direction of the 20 piezoelectric element (13), respectively, for moving in the X-axis direction the second X end (16-2) within the first X area (11-1) from a first X end (16-1) within the reference area (RR) in the center of the piezoelectric element (13) according to driving of the piezoelectric element (13).

25 3. The stage according to claim 1, the first and second X driving parts (11-1,

11-2) comprises first and second X amplifying parts (12-1, 12-2) amplifying a displacement generated according to the driving of the piezoelectric element (13) and moving third and forth X ends (16-3, 16-4) formed in the opponent side of the first X end (16-1) in the direction of X-axis by the amplified displacement, first and second X-line motion parts (13-1, 13-2) shifted in parallel in the direction of X-axis by the amplified displacement, first and second slits (19-1B, 19-1C) connecting the third and fourth ends (16-3, 16-4) to the first and second X-line motion parts (13-1, 13-2), respectively, and a third slit (19-1A) connecting the other end opponent to the end of the first X-line motion part (13-1) connected to the third X end (16-3) to the other end opponent to the end of the second X-line motion part (13-2) connected to the fourth X end (16-4).

4. The stage according to claim 3, wherein the first and second X amplifying parts (12-1, 12-2) comprises first and second pressing parts (14-1, 14-2) receiving the displacement of the piezoelectric element, an intermediate rod formed in the longitudinal direction of the piezoelectric element towards the both sides of the first and second pressing part (14-1, 14-2) in the center of the respective first and second pressing part (14-1, 14-2), and fourth and fifth slits connecting the first and second pressing parts (14-1, 14-2) to the other ends opponent to the ends of the intermediate rod (15-1).

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5. The stage according to claim 4, wherein the intermediate rod comprises a post part (15-A) formed to have a predetermined width, and a narrowing part (15-1B) having a thickness relatively thinner than the width of the post part by a semicircular groove (15-1C) having a predetermined radius in both ends of the post part (15-1A).

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6. The stage according to claim 5, wherein the respective first and second X amplifying part (12-1, 12-2) further comprises a hole (18-1) of a predetermined magnitude in the area surrounded by the fourth and fifth slits, the pressing part (14-1) and the intermediate rod (15-1).

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7. The stage according to claim 6, wherein the first and second X-line motion part (13-1, 13-2) comprises first and second X double springs (13-1B, 13-2B) connected to the third and fourth X ends (16-3, 16-4) through the first and second slits (19-1B, 19-1C), and third and fourth X double springs (13-1A, 13-2A) connected to the first and second X double springs (13-1B, 13-2B) through a pair of slits (19-1D, 19-1E) having a predetermined length and formed in the parallel direction about X –axis, the ends of the third and fourth X double springs (13-1A, 13-2A) being connected each other through the third slit (19-1A).

15 8. The stage according to claim 7, wherein the respective first to fourth X double spring (13-1B, 13-2B, 13-1A, 13-2A) comprises two intermediate rods arranged doubly, the respective intermediate rod comprising a post part (13-1C) having a predetermined width, and a narrowing part having a thickness relatively narrower than the width of the post part by a semicircular groove having a predetermined radius in 20 both ends of the post part (15-1A).

25 9. The stage according to claim 3, wherein the first and second X-line motion part (13-1, 13-2) comprises first and second X double springs (13-1B, 13-2B) connected to the third and fourth X ends (16-3, 16-4) through the first and second slits (19-1B, 19-1C), and third and fourth X double springs (13-1A, 13-2A) connected to the

first and second X double springs (13-1B, 13-2B) through a pair of slits (19-1D, 19-1E) having a predetermined length and formed in the parallel direction about X -axis, the ends of the third and fourth X double springs (13-1A, 13-2A) being connected each other through the third slit (19-1A).

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10. The stage according to claim 9, wherein the respective first to fourth X double spring (13-1B, 13-2B, 13-1A, 13-2A) comprises two intermediate rods arranged doubly, the respective intermediate rod comprising a post part (13-1C) having a predetermined width, and a narrowing part having a thickness relatively narrower than 10 the width of the post part by a semicircular groove having a predetermined radius in both ends of the post part (15-1A).

11. The stage according to claim 2, wherein the Y-axis stage (20) comprises a piezoelectric element having a predetermined length, the length being changed in the 15 direction of X-axis according to an input voltage, and a first Y driving part (21-1) and a second Y driving part (21-2) connected both ends of a longitudinal direction of the piezoelectric element (23), respectively, and fixed to the first Y end (26) of the second X area (RX2) for moving the second Y end (26) opponent to the first Y end (25) in the Y-axis direction on the basis of the piezoelectric element (23).

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12. The stage according to claim 11, wherein the Z-axis stage (30) comprises a bottom part (34) having a predetermined area and thickness and fixing within the second Y area (RY2) of the Y-axis stage (20), a Z-line driving part (31) moving in the direction of Z-axis and formed integrally to the bottom plate (34) in the 25 vertical direction, which is the direction of Z-axis, from the surface of the bottom plate

(34), and a piezoelectric element (33) mounted to have a decreased or increased length in the direction of Z-axis in the space (31-1) of a predetermined size, the space being a region to which the bottom part (34) and the Z-line driving part (31) are adjacent and formed in the Z-axis driving part (31).

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13. The stage according to claim 2, wherein the Z-axis stage (30) comprises a bottom part (34) having a predetermined area and thickness and fixing within the second Y area (RY2) of the Y-axis stage (20), a Z-line driving part (31) moving in the direction of Z-axis and formed integrally to the bottom plate (34) in the vertical direction, which is the direction of Z-axis, from the surface of the bottom plate (34), and a piezoelectric element (33) mounted to have a decreased or increased length in the direction of Z-axis in the space (31-1) of a predetermined size, the space being a region to which the bottom part (34) and the Z-line driving part (31) are adjacent and formed in the Z-axis driving part (31).

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14. The stage according to claim 1, wherein the Y-axis stage (20) comprises a piezoelectric element having a predetermined length, the length being changed in the direction of X-axis according to an input voltage, and a first Y driving part (21-1) and a second Y driving part (21-2) connected both ends of a longitudinal direction of the piezoelectric element (23), respectively, and fixed to the first Y end (26) of the second X area (RX2) for moving the second Y end (26) opponent to the first Y end (25) in the Y-axis direction on the basis of the piezoelectric element (23).

15. The stage according to claim 14, wherein the first and second Y driving parts (21-1, 21-2) comprises first and second Y amplifying parts (21-1, 22-2) connected

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both ends of a longitudinal direction of the piezoelectric element (23), respectively, for amplifying a displacement generated according to the driving of the piezoelectric element (23) and for moving the second Y end (26) in the direction of Y-axis by the amplified displacement, and first and second Y-line motion parts (23-1, 23-2) connected 5 to the first and second Y amplifying parts (22-1, 22-2), respectively, through the first and second slits (27-1, 27-2) traversing a part of the first Y end (26) and shifted in parallel in the direction of Y-axis by the amplified displacement, the other ends opponent to the ends of the first and second Y-line motion parts (23-1, 23-2) connected to the first and second amplifying parts (22-1, 22-2) being connected each other by the third slit (27-3).

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16. The stage according to claim 15, wherein the respective first and second Y amplifying parts (22-1, 22-2) comprises first and second pressing parts (24-1, 24-2) receiving the displacement of the piezoelectric element 23, and an intermediate rod formed in both sides of the first and second pressing part (14-1, 14-2) symmetrically to 15 X-axis in the center of the respective first and second pressing part (14-1, 14-2), the intermediate rod (24) comprising a post part having a predetermined width, and a narrowing part having a thickness relatively narrower than the width of the post part by a semicircular groove having a predetermined radius in both ends of the post part.

20 17. The stage according to claim 16, wherein the first and second X-line motion parts (23-1, 23-2) comprise first and second Y double springs connected to the first and second Y ends through the first and second slits (27-1, 27-2), and third and fourth Y double springs connected to the first and second Y double springs through a pair of slits having a predetermined length and formed in the parallel direction about Y – 25 axis, the ends of the third and fourth Y double springs being connected each other

through the third slit (27-3).

18. The stage according to claim 1, wherein the Z-axis stage comprises a bottom part (34) having a predetermined area and thickness and fixing within the 5 second Y area (RY2) of the Y-axis stage (20), a Z-line driving part (31) moving in the direction of Z-axis and formed integrally to the bottom plate (34) in the vertical direction, which is the direction of Z-axis, from the surface of the bottom plate (34), and a piezoelectric element (33) mounted to have a decreased or increased length in the direction of Z-axis in the space (31-1) of a predetermined size, the space being a region 10 to which the bottom part (34) and the Z-line driving part (31) are adjacent and formed in the Z-axis driving part (31).

19. The stage according to claim 18, wherein the Z-line driving part (31) comprises first and second Z-axis motion parts (31-1, 31-2) moving the first Z end (36) 15 positioned in the direction of Z-axis from the bottom part (34) to Z-axis on the basis of the piezoelectric element according to the driving of the piezoelectric element (33), wherein the respective first and second Z-axis motion part (31-1, 31-1) includes the first and second double springs (31-1A, 31-1B) and the third and fourth double springs (31-2A, 31-2B) arranged in the direction of Z-axis, the ends of the first and third Z double 20 springs being connection through the fourth slit (35).

20. A sample test device using a 3-axis straight-line motion stage, the device comprising:

25 a 3-axis straight-line motion stage supporting a predetermined sample and shifting the sample independently, precisely and exactly in the direction of X-axis, Y-axis

or Z-axis; and

an atom microscope provided with the 3-axis straight-line motion stage for measuring the location of the sample using a laser and for scanning the sample;

wherein the X-axis, the Y-axis and the Z-axis indicate axes of rectangular

5 coordinates, respectively.

21. The device according to claim 20, wherein the 3-axis straight-line motion stage comprises

a bottom plate (40) having predetermined area and thickness;

10 a X-axis stage (10) fixed in a reference area (RR) of the bottom plate (40) for moving in the direction of X-axis a first X area (RX1) positioned from the reference (RR) to the direction of X-axis;

a Y-axis stage (20) positioned within the first X area (RX1) and fixed in a second X area (RX2) within the first X area (RX1) for moving in the direction of Y-axis a second 15 Y area (RY1) positioned from the second X area to the direction of Y-axis; and

a Z-axis stage (30) fixed in the second Y area (RY2) within the first Y area (RY1) and supporting a predetermined sample for moving the sample in the direction of Z-axis;

wherein, the X-axis, the Y-axis and the Z-axis indicate axes of rectangular coordinates, respectively.

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22. The device according to claim 21, wherein the Y-axis stage comprises a piezoelectric element having a predetermined length, the length being changed in the direction of X-axis according to an input voltage, and a first Y driving part (21-1) and a second Y driving part (21-2) connected both ends of a longitudinal direction of the 25 piezoelectric element (23), respectively, and fixed to the first Y end (26) of the second X

area (RX2) for moving the second Y end (26) opponent to the first Y end (25) in the Y-axis direction on the basis of the piezoelectric element (23).

23. The device according to claim 22, wherein the Z-axis stage comprises  
5 a bottom part (34) having a predetermined area and thickness and fixing within the second Y area (RY2) of the Y-axis stage (20),

a Z-line driving part (31) moving in the direction of Z-axis and formed integrally to the bottom plate (34) in the vertical direction, which is the direction of Z-axis, from the surface of the bottom plate (34), and

10 a piezoelectric element (33) mounted to have a decreased or increased length in the direction of Z-axis in the space (31-1) of a predetermined size, the space being a region to which the bottom part (34) and the Z-line driving part (31) are adjacent and formed in the Z-axis driving part (31).

15 24. The device according to claim 21, wherein the Z-axis stage comprises a bottom part (34) having a predetermined area and thickness and fixing within the second Y area (RY2) of the Y-axis stage (20),

a Z-line driving part (31) moving in the direction of Z-axis and formed integrally to the bottom plate (34) in the vertical direction, which is the direction of Z-axis, from the 20 surface of the bottom plate (34), and

a piezoelectric element (33) mounted to have a decreased or increased length in the direction of Z-axis in the space (31-1) of a predetermined size, the space being a region to which the bottom part (34) and the Z-line driving part (31) are adjacent and formed in the Z-axis driving part (31).